1.0 Executive Summary

St. Lawrence Cement, LLC ("SLC") has prepared and is submitting these comments in response to the comments submitted by Friends of Hudson ("FOH"), the Massachusetts Department of Environmental Protection ("MaDEP"), and the Connecticut Attorney General relative to the air emissions control technologies appropriate for controlling nitrogen oxides ("NO_x") from the SLC replacement cement plant in Greenport, New York (the "Greenport Project"). SLC will use the latest, most effective and reliable environmental control technologies for the Greenport Project despite claims made to the New York State Department of Environmental Conservation ("NYSDEC") by Project opponents and other interested parties. The comments were submitted in response to SLC's December 2003 report entitled *St. Lawrence Cement Greenport Project, SLC Hudson Valley Operation, Lowest Achievable Emission Rate Supplemental Analysis* (hereinafter referred to as the "SLC Report").

SLC intends to use, in combination with multi-staged combustion ("MSC"), selective non-catalytic reduction ("SNCR") technology to control NO_x due to the proven capabilities of those technologies within the greater cement industry, whereas commentors claim that the utilization of selective catalytic reduction ("SCR") will provide better NO_x emission control. As detailed in the SLC Report and herein, SCR is still an unproven; *i.e.*, experimental, technology in the cement industry that is likely to fail at the Greenport Project.

FOH repeatedly attempts to discredit not only the conclusions reached by SLC's experts but the process that was employed as well. FOH misrepresents the facts of the process, draw conclusions from incomplete, inaccurate and inadequate data, speculate about the intent of procedures without any foundation whatsoever, and fail to even address the written response from one of the vendors they contacted, which confirms that SCR will not succeed in the operating environment associated with the Greenport Project. Specifically, in response to claims made in a paper entitled *Friends of Hudson Response to St. Lawrence Cement's Supplemental LAER Analysis* (hereinafter "FOH Response"), SLC submits this rebuttal to demonstrate that: (1) The application of SCR to the Greenport Project is not technically feasible; (2) SCR systems are not commercially available for the Greenport Project; (3) The combination of MSC and SNCR is likely to provide equal to or higher NO_x reductions than SCR; and (4) NYSDEC's previous NO_x LAER determination for the Greenport Project remains valid.

The Application of SCR to the Greenport Project is Not Technically Feasible

The differences between the Greenport Project and Solnhofer and between the Greenport Project and coal- and oil-fired utility boilers make the transfer of SCR technically inappropriate. Despite the fact that no data has been provided to show a demonstrated application of SCR in a similar environment to that of SLC Greenport, the FOH Response claims that the various unresolved technical obstacles to application of SCR have been resolved at other installations.

Specifically to Solnhofer, the SLC Report found that significant differences exist between Solnhofer and the Greenport Project. These differences demonstrate that, despite superficial similarities between the two plants, the Solnhofer SCR experience is inapplicable to the Greenport Project. In addition, the sparse technical information available regarding the Solnhofer SCR installation is insufficient to explain how Solnhofer addressed, or failed to address, major technical concerns of applying SCR to a gas stream such as that expected from the Greenport Project. The FOH Response offers no additional verifiable information (*e.g.*, certified emission monitor data, raw material tests, stack tests, catalyst life, operation logs, maintenance logs) to support claims that SCR has been demonstrated on a cement plant. The only additional information offered by FOH is hearsay and unverified vendor supplied statements that are contradicted by the data obtained from the German regulatory authorities.

The FOH Response also claims that "many of the issues raised by SLC have been addressed at SCR installations on dozens of coal and oil-fired power plants." Specifically they cite the Kansas City P&L example (specific plant and unit not specified). Using FOH’s own table, however, which they offer in support of this claim, the gas characteristics of the example cited are not even close to being comparable to those of Greenport and the installation is only achieving a 55% reduction in NO_x. Case in point compared to Greenport, the Kansas City P&L gas stream (1) has an inlet NO_x concentration that is only 27%, (2) has a much higher gas temperature, (3) has only 54% of the dust loading, (4) has 70% of the sulfur dioxide ("SO_2") concentration, (5) has 28% of the calcium oxide ("CaO") concentration, and (6) has only 18% of the potassium. Appendix C to the FOH Response also includes data from an unspecified plant in Somerset, New Jersey, and an unspecified power plant operated by Carolina Power & Light. Neither example provides a meaningful comparison to the proposed Greenport Project. For example, the Carolina Power & Light SCR system was exposed to dust loadings less than 2% of the levels expected at Greenport. The Somerset example (specific plant and unit not specified) had (1) a dust loading less than 20% of Greenport, (2) sodium levels less than 31% of Greenport, and (3) potassium levels less than 30% of Greenport. As described in Section 4 of the SLC Report and as recognized by one of FOH's vendors (Hitachi), these differences between these plants and the Greenport Project are very important to the potential failure of SCR.

Additionally, the FOH Response implies that the significant differences identified between the Greenport plant and other facilities that are operating SCR systems are not significant and/or can readily be addressed in the design and operation of the system. However, once again the FOH Response failed to provide any substantive evidence in this regard, and in one instance (the Hitachi email) provides evidence to the contrary.

SCR Systems are NOT Commercially Available for the Greenport Project

Several of the commenters criticize SLC's Bid Specification as being unreasonably strict and offering no opportunity for discussion or negotiation. On the contrary, SLC set reasonable performance requirements, not to discourage the bidders, but to reflect the reality of the gas stream associated with the Greenport Project. The Bid Specification requirements are justified and reasonable as detailed herein and in the SLC Report. In addition, SLC stated clearly, early and often, the opportunity for any vendor to take exception to any of the performance criteria provided they could back up the exceptions with sound technical explanations as to why the exceptions were taken.

As presented in the SLC Report, SLC's request for bids from four SCR vendors resulted in no firm and properly guaranteed bid to provide an SCR system for the Greenport Project. Each of the four could not commit to meeting the Bid Specification requirements, which, as is noted above, was tailored to reflect the harsh operating conditions in which the SCR system must operate, not to discourage the bidders. Rather than dealing with the realities of the gas stream associated with the proposed Greenport Project, FOH changed the specifications for the bid, which rendered them meaningless for the Greenport Project. Although FOH succeeded in obtaining a revised proposal from one of the SCR vendors, KWH, the proposal is hedged to the point of rendering it useless for the Greenport Project. In addition, KWH's rejection of a key specification regarding SO_2 oxidation causes the proposal to be both unrealistic and a significant risk to the environment and the community.[1]

The Combination of MSC and SNCR is Likely to Provide Equal to or Higher NO_x Reductions Than SCR

The only "hard data" about emissions from the Solnhofer kiln are contained in the annual continuous emission monitoring systems ("CEMS") emissions reports for the period 1992-2002 inclusive, as reported to the German regulatory authorities. SLC analyzed this data to determine how the SCR system affected NO_x emissions on an annual average basis. The conclusion supported by publicly available data is that the estimated NO_x reduction efficiency by the Solnhofer SCR system in 2002 was around 40% or less (on an annual average basis) when compared to emissions from the plant prior to the installation and operation of the SCR.

The FOH Response attempts to explain the huge discrepancy between their claims of 82% NO_x reduction at Solnhofer and the 40% reduction calculated utilizing certified, verifiable public emission data, by claiming that the Solnhofer plant was operating an effective SNCR system in 1999 and 2000. This again is not supported by hard data. NO_x reduction efficiencies of the SCR system in 2002 compared to 1992-1994, the period prior to Solnhofer obtaining a permit to trial SNCR, average only 34%. Despite vendor (presumably short-term reduction efficiency) claims, no long-term and certified SCR inlet NO_x concentration data are publicly available; therefore, a higher NO_x reduction efficiency, as purported by KWH and FOH, cannot be substantiated by available data.

Given that possible NO_x emissions reduction efficiencies are no greater than SNCR and a very real probability that an SCR system applied to the Greenport Project would fail and ultimately end up being abandoned or removed, there is no reason to consider the additional risks associated with SCR as being worth the unknown potential for additional NO_x reductions that might (or might not) be achieved through application of SCR.

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1 Also unexplained is KWH's vacillation regarding this issue. Originally, they indicated to the United States Environmental Protection Agency ("USEPA") in an e-mail communication their ability to supply an SCR system for the Greenport Project with a 90% reduction efficiency. Then, when faced with specifications that reflect the reality of the gas stream associated with the Greenport Project, they declined to bid; now, after the bid specifications were diluted and significant issues were disregarded they again indicate their willingness to supply an experimental SCR system for the Greenport Project.

SLC’s Regulatory Analysis is Beyond Reproach

Finally, notwithstanding the criticisms put forth by the commentors, SLC's regulatory analysis is beyond reproach. SCR has not been achieved in practice, because Solnhofer is not in the same source category as the Greenport Project, and, even if it was, SCR has not been achieved in practice at Solnhofer. Additionally, SCR cannot reasonably be expected to occur in practice at the Greenport Project, because SCR is not commercially available for the Greenport Project, and, even if it was, SCR is technically infeasible for the Greenport Project. Accordingly, the previous NO_x LAER determination for the Greenport Project remains valid.

2.0 Introduction & Background

In May 2001, the NYSDEC determined, pursuant to its air quality non-attainment new source review ("NSR") regulations, that LAER for the control of NO_x emissions from the kiln system at SLC’s Greenport Project will be achieved largely from the innovative, combined application of SNCR and MSC technologies. NYSDEC, in July 2003, asked SLC to update its LAER submittal to provide the Department with additional information regarding potential NO_x control technologies for the Greenport Project. The SLC Report, submitted in December 2003, provided the information requested and unequivocally demonstrated that NYSDEC has properly concluded that NO_x LAER for the Greenport Project is an emissions rate based on the application of SNCR and MSC technology. Moreover, through an updated NO_x LAER regulatory analysis, the SLC Report demonstrated that SCR has not been achieved in practice for the Greenport Project's source category nor is a successful application of SCR expected to occur in practice at the Greenport Project. On March 24, 2004, the Project opposition group, FOH, submitted the FOH Response and the MaDEP and Connecticut Attorney General submitted comments on the SLC Report.

Importantly, as this document presents, while the SLC Report is based on the *verified*, *factual* information SLC gathered through extensive efforts, the FOH Response, MaDEP and the Connecticut Attorney General comments rely heavily on hearsay and one vendor’s unproven claims. This document (1) answers, and in many instances contradicts, the unfounded claims presented in the FOH response, (2) supports the conclusions of the SLC Report, and (3) validates NYSDEC's previous NO_x LAER determination for the Greenport Project.

3.0 Technical Review of SNCR and MSC Technology

SLC proposed in its air permit application to use all technically feasible and proven primary NO_x control strategies, including MSC, at the Greenport Project. In addition, SLC proposed to incorporate the secondary control method of SNCR. Initial permit limits are set in the draft permit issued by NYSDEC. Through the use of an optimization period, SLC will control NO_x emissions at or below established NO_x LAER limits. NYSDEC has accepted these methods and their resulting NO_x emission rate as LAER for the Greenport Project. The USEPA has concurred in this analysis.

The commentors claims that (1) given SLC's reluctance to consider SCR due to its limited use in the cement industry, it is very curious that SLC does not have same concerns for the untested combination of SNCR and MSC; (2) experience with SCR in power plants is well established and does not involve the operational difficulties of an SNCR system, (3) recent adaptations of SCR to cement plants have demonstrated that key issues have been resolved and that SCR is far less innovative and experimental than SNCR/MSC and will provide dramatically greater levels of NO_x emission reductions, and (4) proposed CO levels for the Greenport Project are high when compared to the CO levels at Solnhofer. Each of these claims is refuted below.

(1) In order to comprehend why the application of MSC and SNCR to Greenport is innovative while SCR must be considered highly experimental, it is essential to understand two primary, yet distinct, concepts. These concepts are:

- Technical feasibility, or the "ability to perform;" and
- The "level of performance" of the technology combination.

MSC and SNCR

While the combination of MSC and SNCR is innovative, each technology's "ability to perform" reliably in the environment of a cement kiln has been demonstrated repeatedly. This conclusion is based on the recent advancements of SNCR technology at European cement plants, where 16 systems have been installed and operated for years with varying degrees of success, and the now industry standard to install MSC technology to reduce NO_x emissions at precalciner cement plants. The experiences gained from many of these installations demonstrate SNCR's and MSC's ability to perform in the environment of a cement kiln.

It is the combination of SNCR and MSC and the application of SNCR under domestic regulatory conditions, which is innovative. It is not a question of whether this combination of technologies will work successfully in the operating environment associated with the gas stream at the proposed Greenport Project. The only open question is the optimum "level of performance" that can be achieved (or how significant the NO_x reductions will be) by this combination of technologies at the Greenport Project without creating undesired consequences, such as ammonia slip. Resolution of this question requires an optimization study – something that is common practice when SNCR is used as the technology basis for establishing an emissions limit for a source. The fact that MSC and SNCR require further optimization to determine how effective those technologies can be without creating undesired consequences does not mean that those technologies are at risk of failure. The cement industry's experience base with MSC and SNCR means that there is virtually zero risk that this combination of NO_x reduction technologies will fail. For example, there is no question that an aqueous based ammonia compound can be injected into the riser duct of the preheater tower through a system of nozzles and there is no question that the nozzles, which only penetrate the exterior skin of the riser duct, are not at risk to the same degree as the SCR catalyst bed, which is located in the path of the gas stream. Likewise, based upon the extensive experience in cement kilns with variable raw feeds, there is no question that MSC can work without the risk of failure. Further, SLC has a vendor guarantee from Krupp-Polysius for SNCR, which accounts for all of the operating conditions at the proposed Greenport Project without creating any unnecessary environmental risk.

SCR

Conversely, SCR's "ability to perform" in the environment of a cement kiln, particularly in an environment similar to that for the proposed Greenport Project, has not been demonstrated. The FOH Response provided no additional data beyond hearsay and unsubstantiated vendor claims. Significant unresolved technical difficulties remain, therefore, concerning the ability of SCR to perform at the Greenport Project. None of the available data on Solnhofer (the only known large scale application of SCR to a cement kiln) address the issues of *long-term performance and reliability* of the SCR system and catalyst. The sparse technical information that is available is insufficient to explain how Solnhofer addressed, or failed to address, major technical concerns of applying SCR to a gas stream such as that expected from the Greenport Project. The unresolved technical issues together with the significant differences in the gas streams between Solnhofer and Greenport, or a utility boiler and Greenport, render the suggested application of SCR at the Greenport Project environmentally risky and highly experimental. In other words, there is a very real risk that application of SCR to the Greenport Project will be a complete failure, and an even larger risk that if the technology does work, it will perform at a level below the performance level that will be achieved by the combination of MSC and SNCR.

The second concept of "level of performance" is obviously highly dependent on the SCR's ability to perform. It is not possible, therefore, to predict SCR's NO_x reduction potential in a gas stream similar to Greenport. For instance, if the SCR catalyst is deactivated by one or more mechanisms or if the SCR must be bypassed regularly due to its incompatibility with gas stream characteristics, the level of performance will drop dramatically. Both of these events are likely to occur as was confirmed by one of the vendors responding to FOH's bid request (Hitachi).

In summary, the environmentally responsible choice, and therefore the control technology required to achieve LAER, for the Greenport Project is the combination of MSC and SNCR. Whereas there is virtually zero risk that the combination of MSC and SNCR NO_x reduction technologies will fail, there is a very real risk that application of SCR to the Greenport Project will be a complete failure, and an even larger risk that if the technology does work, it will perform at a level below the performance level that will be achieved by the combination of MSC and SNCR.

(2) Whether or not SCR is well established in power plants is immaterial. The FOH Response illustrates their refusal to acknowledge that cement kiln systems are inherently different from utility boilers and power generation systems. While experience with SCR in power plants is instructive, it does not transfer directly to cement plants due to the inherently different gas stream and particulate matter characteristics. This, too, was recognized by Hitachi in its response to the FOH bid request, but was not discussed by FOH in the FOH Response.

FOH also claims that SCR is well established and does not involve the operational difficulties of an SNCR system. On the contrary, the SNCR operational issues, such as injection locations, molar ratios, and ammonia slip are also issues for SCR. SCR operational difficulties are compounded because an SCR system places a catalyst bed in the path of the gas stream where it is vulnerable to high particulate matter loadings, high SO_2 concentrations, high alkali levels, high calcium-containing particulate matter concentrations, and other materials that can suppress catalyst activity. In contrast, SNCR uses nozzles to inject dilute ammonia into the gas stream and requires no catalyst bed. As noted above, since the nozzles only penetrate the outer skin of the riser duct and are easily replaceable, there is little to no operational risk of failure associated with the SNCR system.

(3) The best estimate available on NO_x reduction efficiency utilizes certified and publicly available data. The conclusion supported by public data is that the estimated NO_x reduction efficiency by the Solnhofer SCR system in 2002 was around 40% or less (annual average). If, in fact, SCR could perform at Greenport at the same 40% NO_x control efficiency actually achieved at Solnhofer, SCR would be no better than the NYSDEC's current LAER determination for the Greenport Project. Despite vendor (presumably short-term efficiency) claims, no long-term and certified SCR inlet NO_x concentration data are publicly available; therefore, a higher long-term SCR NO_x reduction efficiency for cement kilns cannot be substantiated by available data. Moreover, unverified reports associated with the Solnhofer facility lead SLC to believe that the facility has been experiencing SCR plugging problems over the last few months associated with a fuel change, which eliminates the unique operating conditions that are favorable to SCR. Furthermore, unverified reports to SLC are that the Solnhofer facility is currently considering the installation of a full-scale SNCR.

The FOH Response attempts to explain the huge discrepancy between their claims of 82% NO_x reduction at Solnhofer and the 40% reduction calculated utilizing certified, verifiable public emission data, by claiming that the Solnhofer plant was operating an effective SNCR system in 1999 and 2000. FOH has alleged, therefore, that SLC's consultant was incorrect to compare 1999 and 2000 average NO_x emissions to NO_x emissions in 2002 in order to determine the NO_x control levels obtained by SCR at Solnhofer. Alternatively, they suggest that the facility's uncontrolled NO_x emission rate should be compared to the 2002 average NO_x emission. The major flaw in their proposal is that long-term NO_x inlet data is not publicly available, is not verifiable, and probably was not collected utilizing a certified monitor.

In response to the possibility that Solnhofer employed some form of SNCR during 1999 and 2000, SLC's consultant again reviewed the certified NO_x emission data. It is apparent from the histograms submitted by Solnhofer to the German regulatory authorities that NO_x emissions remained fairly consistent from 1992 through 2000, therefore, the SNCR was either not utilized or was minimally effective. (*See* SLC Report, Attachment 1, Document 8.) Nonetheless, SLC's consultant calculated average NO_x emission data for 1992 through 1998. (Note that the earliest the Solnhofer facility could have been operating an SNCR was late 1995, as the facility received their trial urea injection (SNCR) permit in November 1995. *See* SLC Report, Attachment 1, Document 5.) This analysis shows that the Solnhofer plant's NO_x emissions (measured in mg/m^3) for 2002 (when the SCR system was reportedly operating) averaged 66% of the emissions during the 1992 through 1994 period (when no SCR or SNCR system was reported to be in operation). This is a fact that is supported by the certified emissions monitor data reported to the German regulatory authorities. One way to view these data is that the application of the SCR system only reduced long-term average NO_x emissions from the Solnhofer cement kiln by 34%, a value far below the 82% reduction efficiency being touted for this system.

Given that the apparent long-term average NO_x emissions reduction efficiencies achieved at Solnhofer are not markedly different from the NO_x reduction efficiency expected from SNCR at the Greenport Project and a very real possibility exists that an SCR system applied to the Greenport Project would fail and ultimately end up being abandoned or removed, there is no reason to consider the additional risks associated with SCR.

(4) FOH also questions the proposed CO limits for the Greenport Project, which further demonstrates their lack of knowledge and understanding of the differences between the preheater kiln at Solnhofer and the preheater/precalciner kiln at Greenport. CO emissions from a straight preheater kiln, such as the kiln at Solnhofer, are attributable predominately to the incomplete combustion of low concentrations of organic matter in raw material, CO emissions from the kilns are probably quite low due to the favorable combustion conditions that exist in all cement kilns. In a preheater/precalciner kiln, 50-60% of the fuel is burned in the precalciner at much lower temperatures than the kiln and this contributes to some precalciner CO emissions in addition to the raw material-related CO emissions. Preheater/precalciner kilns all exhibit higher

CO emissions than would typically be found in a straight preheater kiln, a further indication that the Greenport kiln is in a different source category than the Solnhofer kiln.

4.0 Technical Evaluation of SCR as NO_x LAER for the Greenport Project

Unresolved technical difficulties remain as to the potential to apply SCR to the Greenport Project, due to issues including, but not limited to, catalyst deactivation via plugging; fouling; masking or poisoning; SO_2 oxidation; gas temperature ranges and fluctuation; variation in NO_x control efficiency and NO_x inlet concentration; undesirable byproduct formation and the impact on downstream equipment; startup, shutdown, and malfunction events; gas flow distribution; and "sticky" deposits.

4.1 Response to SO_2 Oxidation, Catalyst Deactivation, Undesirable Byproducts and Sticky Deposit Comments

KWH's refusal to guarantee SO_2 oxidation levels, along with their cursory and unsubstantiated claims that SO_3 and calcium compounds, particularly CaO and $CaCO_3$, will not present a problem for operation of the SCR system, render their claim of SCR performance merit-less.

As explained in the SLC Report, three issues are associated with the formation of SO_3 in the SCR system: (1) the formation of SO_3 and H_2SO_4 from SO_2 in the SCR, (2) the reactions of SO_3 and/or H_2SO_4 with calcium containing particles trapped in the SCR catalyst macropores, and (3) the formation of sticky deposits due to the capture of some of the SO_3 and/or H_2SO_4 on calcium-containing particles in the gas stream exiting the SCR.

As noted in the SLC Report, SLC has significant concerns regarding SO_2 to SO_3 conversion rates of only 0.5% to 2%, a range common in coal- and oil-fired boiler SCR applications. However, this range of conversion rates is far below the 50% to 70% SO_2 to SO_3 conversion rate quoted by FOH response, p. 32, with respect to Solnhofer. These are such excessive conversion rates that SLC questions their accuracy. At the extreme SO_2 conversion rates quoted by FOH, the concentration of SO_3 and its reaction product H_2SO_4 would be in the range of 1,275 to 1,785 mg/Nm^3 (300 to 420 ppm). SLC has not found any data whatsoever that addresses these extreme, and if accurate, highly consequential concentrations of SO_3 and H_2SO_4 in an SCR catalyst bed and in the gas stream exiting an SCR catalyst bed.

There is ample technical data to demonstrate that SO_3 formed on the surfaces of the SCR catalyst will react with calcium compound particles trapped in the macropores of the catalyst. The SO_3-calcium compound reactions result in the formation of non-volatile sulfate compounds that are retained in the catalyst pores and cause masking-related deactivation of the affected portion of the catalyst. Considering that masking is a long-term SCR catalyst deterioration issue, even a small yield in the SO_3-calcium compound reactions is of concern on the SCR catalyst surface. The concerns regarding masking are also raised by Hitachi to CDM regarding the Greenport Project. Quoting from the e-mail from Howard Franklin to Frank Sapienza: "2) CaO amount: CaO loading is 15-30 times of PRB application. So, the masking is an extremely large and unpredictable problem. We anticipate that the catalyst will deteriorate very quickly. It is not possible to evaluate the catalyst life and offer any guarantees." SLC shares these concerns regarding SCR catalyst masking-related deterioration.

SLC does not share FOH's optimism concerning the fate of any SO_3 that forms from SO_2 on the surface of the SCR catalyst, penetrates the SCR catalyst bed, and leaves with the gas stream. FOH appears to believe that the residual SO_3 (and its reaction product H_2SO_4) in the gas stream will react with calcium particles also entrained in the gas stream and will be removed harmlessly as particulate matter. There is no technical basis for this conclusion because the Solnhofer unit with its inherently low inlet SO_2 concentrations does not generate high concentrations of sulfuric acid.

The extreme and unusual SO_3 formation rates provided by the KWH catalyst coupled with the inherently high SO_2 concentrations anticipated at Greenport create a potential for very high SO_3 concentrations in the gas stream exiting the SCR. The possible consequences of SO_3 and H_2SO_4 presence in the gas stream include (1) the formation of sticky particulate matter deposits, (2) corrosion of downstream equipment, and/or (3) the emissions of sulfuric acid. SLC does not believe that there are any data or information that provides a sound basis for determining the fate of the high levels of SO_3 that would form in a KWH-supplied SCR catalyst at Greenport.

FOH further displays a lack of knowledge of cement pyroprocessing systems when they state that 90% of the total sulfur dioxide in a kiln effluent gas stream will be captured in the evaporative cooler-fabric filter. They use this assumption to back calculate the inlet SO_2 concentrations at the Solnhofer SCR to justify their conclusion that it was in-fact exposed to high

SO_2 concentrations. They calculate that the actual SO_2 concentration at the inlet of the SCR at Solnhofer could be as high as 400 mg/Nm^3, and they conclude that this compares to the 1,700 mg/Nm^3 SO_2 concentration estimated by SLC. The FOH assumptions and calculations are summarized in a step-by-step manner in Table 1.

Table 1. FOH back-calculated SO_2 concentrations at Solnhofer

Concentration, mg/Nm^3	Location	Assumption
6	Solnhofer stack	None – measured data
60	Inlet to the Solnhofer evaporative cooler	90% SO_2 scrubbing in "dry scrubber-like evaporative cooler and fabric filter"
120	Inlet to the Solnhofer in-line raw mill	50% SO_2 scrubbing in the raw mill
400	Inlet to the Solnhofer SCR	70% SO_2 oxidation in the SCR[2]

Perplexingly, the basis for the FOH assumed 90% SO_2 scrubbing in the evaporative cooler and fabric filter is not clear. Actual SO_2 scrubbing efficiencies in the downstream evaporative cooler-fabric filter are low-to-negligible. If FOH were correct about this SO_2 removal efficiency, SLC would have no need for the SO_2 wet scrubbing system after the fabric filter. The SO_2 efficiency for the wet scrubbing system is essentially identical to the optimistic 90% scrubbing efficiency that FOH expects in the evaporative cooler-fabric filter.

It should be further noted that German regulatory authorities issuing the permit to the Solnhofer plant probably did not classify the evaporative cooler and fabric filter as an SO_2 control system. This would have been a substantial over-sight on the part of the Solnhofer facility and the German regulatory authorities if, in fact, the evaporative cooler-fabric filter provided 90% SO_2 control due to its performance as a "dry scrubber".

[2] SLC questions the accuracy of such excessive conversion rates across an SCR. These levels are out of balance with conventional SCR systems where SO_2 oxidation fractions are typically a few percent.

Removing the imaginary SO_2 control efficiency across the Solnhofer evaporative cooler and fabric filter results in the revised estimated SO_2 levels summarized in Table 2.

Table 2. FOH back-calculated SO_2 concentrations at Solnhofer, corrected for actual conditions in the evaporative cooler and fabric filter

Concentration, mg/Nm^3	Location	Assumption
6	Solnhofer stack	None – measured data
6	Inlet to the Solnhofer evaporative cooler	0% SO_2 scrubbing
12	Inlet to the Solnhofer in-line raw mill	50% SO_2 scrubbing in the raw mill
40	Inlet to the Solnhofer SCR	70% SO_2 oxidation in the SCR[3]

The resulting SO_2 concentration estimate at the inlet to the Solnhofer SCR is 40 mg/Nm^3 if one attributes a 70% oxidation fraction to the SCR system. Accordingly, the actual SO_2 concentrations at the inlet of the Solnhofer SCR are probably in the range of 40 mg/Nm^3 or less. The Solnhofer SO_2 levels are approximately 2.35% of the 1,700 mg/Nm^3 SO_2 levels expected at Greenport. The SO_2 levels at the inlet of the Solnhofer SCR are not representative of the conditions expected at Greenport, which is, yet again, further evidence of the distinctness of the source categories.

FOH has attempted to further argue that Solnhofer is representative of Greenport by using one-half hour SO_2 peak concentrations (11 mg/Nm^3 at Solnhofer). This is not appropriate because the consequences of SO_2 oxidation to SO_3 are related to long-term material accumulation and masking, not to short term peak conversion rates.

Without an understanding of the processes inherent to and the differences applicable to preheater versus preheater/precalciner systems and without substantially more information about the forms and distribution of sulfur present at Solnhofer, the FOH Response calculations are unfounded, speculative and undoubtedly completely incorrect.

As stated in the SLC Report, the presence of calcium and of sulfur oxides in the gas stream of preheater and preheater/precalciner kilns are well known contributors to sticky deposits that

[3] SLC questions the accuracy of such excessive conversion rates across an SCR.

become a hard, persistent scale at any points of impingement of the gas stream in the temperature ranges required at the SCR. The claims of the FOH Response that the problem of the scale formation is solely a problem of high impact velocities associated with ID fans is further speculation without substantiation and does not match the experience of cement plant operators that any point of impingement of the gas stream is subject to the deposits. It is only logical to assume that if these deposits form on fan blades and other points of impingement that they can certainly form in the chambers associated with a catalyst bed of any design. Since catalyst beds are designed to provide catalyst surface contact (*i.e.*, impingement) with the gas stream, FOH's dismissal of this issue is without foundation.

The failure to recognize these factors indicates a lack of knowledge and experience on the part of KWH, FOH and CDM with cement pyroprocessing processes in general, and in particular, modern preheater/precalciner kilns. KWH's failure to offer a guarantee regarding SO_3 oxidation is a major concern. There are two possible and environmentally risky outcomes resulting from the lack of consideration of these factors. One is that an SCR system installed at Greenport will quickly deactivate due to the combination of catalyst masking by calcium sulfate formation in the pores of the catalyst and by the rapid build up of a hard and persistent scale on the surface of the catalyst, as Hitachi has predicted. The result will be a pyroprocessing system without a functioning NO_x emissions control. The other is that significant levels of sulfuric acid mist will be generated during the period prior to the deactivation of the catalyst by the mechanisms mentioned above. This is similar to a situation that occurred with a SCR application at the General Gavin power plant near Cheshire, Ohio. This type of risk to the environment should not be tolerated with a highly experimental technology in this source category.

On page 24 of the FOH Response, it is claimed that the adequate performance of SCR systems on oil-fired boilers demonstrates that water soluble alkalis are not a major concern for Greenport. This conclusion further demonstrates a lack of understanding on the part of FOH regarding the significant differences between oil-fired boilers and cement kilns. The particulate matter loadings in oil-fired boilers are sufficiently low that many utility scale oil-fired boilers do not need particulate matter control systems. USEPA emission factors for particulate matter emissions from oil-fired boilers indicate that emissions from a unit fired with 2% sulfur (by weight) oil would be equivalent to 0.24 grams per Nm^3. At an alkali content ranging from

10% to 25% by weight of the flyash, the total alkali content in particulate matter in an oil-fired boiler with this type of fuel is approximately 0.024 to 0.060 grams/Nm^3. This is a factor of 12 to 31 times below the 0.750 grams/Nm^3 alkali concentration estimated for Greenport. Furthermore, the particulate matter in an oil-fired boiler passes through the combustion chamber, and a portion of the ash is present in the form of fused, glass-like particles. In this form, the alkali present in the glass-like particles has little opportunity to poison the SCR catalyst. Accordingly, the SCR systems on oil-fired boilers can tolerate the typical alkali levels. Conversely, in a cement kiln, the feed containing alkali enters from a countercurrent direction and does not enter the high temperature combustion zone where temperatures are sufficiently high to form glass-like particles. In cement kilns, the alkali is vaporized in the lower temperature regions of the kiln and the vapors heterogeneously nucleate to the surfaces of entrained kiln feed particles. On the surfaces of these particles, the alkali are readily available to poison the SCR catalyst. FOH's claim that oil-fired boiler SCR experience demonstrates that an SCR would work at Greenport is without merit because (1) the alkali levels at Greenport are expected to be 12 to 31 times higher, and (2) the alkali in cement kilns is more readily available to poison SCR catalysts due to position on the surfaces of particles.

On pages 25 and 26 of the FOH Response, FOH argues that the performance of SCR systems on coal-fired boilers does demonstrate that water soluble alkali particulate matter does not cause catalyst deactivation. This opinion is based on an observation that acidic water soluble deposits ("low temperature deposits") can accumulate on the economizer and air preheater heat exchange surfaces of coal-fired boilers. The presence of these acidic deposits is not relevant to the issue of water soluble alkali in an SCR. The "low temperature deposits" in the economizer are primarily flyash with some adsorbed sulfuric acid. The presence of the hydgroscopic sulfuric acid accounts, in part, for the presence of water that can hydrate a portion of the flyash particle. As indicated by FOH, these deposits can be acidic. Clearly, high concentrations of alkali compounds would lead to basic (high pH) material not acidic (low pH) material. The "low temperature deposits" referenced in the FOH document are not relevant to the issue of SCR catalyst deactivation.

Actually, there is information available concerning an entirely different type of deposit in coal-fired boilers that is potentially relevant to the availability of alkalis to poison SCR systems in coal-fired boiler applications. Research conducted by boiler operators has indicated that water soluble alkali as measured by extracting water soluble sodium from coal prior to combustion is related to the formation of sticky sintered particles on the high temperature heat exchange surfaces of the boiler superheater and reheaters. The particles containing alkali arrive on the high temperature tubes as molten or plastic particles. They sinter on the high temperature tubes to yield hardened deposits. The alkali-containing particles that escape capture on the superheater and reheater tubes cool to form the glass-like particles discussed in the SLC Report. It is also interesting to note that potassium, the main form of alkali in the Greenport feed stream, is usually not considered a "water soluble alkali" with respect to the sintered flyash deposits.

Likewise, coal-fired boilers are also inherently co-current processes, while cement kilns are counter-current processes. In coal-fired boilers, all of the fuel enters the combustion chamber and is exposed to gas temperatures exceeding 1315ºC (2400ºF). The flyash is in a molten or plastic state at this temperature. As the particles move co-currently with the gas stream through the boiler, the flyash particles cool to form glass-like particles, some of which are hollow spheres termed cenospheres. The alkali is partially trapped in the glass-like particles. Conversely, as discussed above, in cement kilns, the alkali compounds are volatilized from the feed stream, which is moving in a counter-current direction with respect to the gas stream. The alkali are vaporized from the feed materials when they reach a part of the process when the gas temperatures are in the range of 315ºC to 540ºC (approximately 600ºF to 1000ºF). This temperature range is well below the level associated with ash softening. Accordingly, the particles does not form glass-like spheres, cenospheres or otherwise. Instead, a portion of the vaporized alkali heterogeneously nucleates on the surfaces of entrained feed particles moving toward the SCR. The alkali compounds can contact the SCR catalyst and thereby contribute to catalyst poisoning. In cement kilns, the vulnerability to SCR catalyst poisoning depends on both the total quantity of alkali in the feed material and the surface concentrations of alkali particles entering the SCR. Cement kilns are inherently more vulnerable to alkali-related poisoning of SCR catalysts than coal-fired boilers.

Additionally, the MaDEP claimed that recent catalyst technology resolves the concerns about SO_2 oxidation. Their support for this claim is a paper from Babcock-Hitachi entitled, *Recent Experience with SCR Catalyst for PRB Fuels, High Sulfur Fuels and Low Dust Applications*.

This paper goes on to state: "However, the activity of this new catalyst drops off rapidly at lower temperatures. Thus this catalyst may not be appropriate for boilers operated with large load swings." Furthermore, the operating temperature range mentioned for this catalyst in Table 7 of the paper is 700^{o}F to 780^{o}F or 371^{o}C to 415^{o}C, far higher that the temperatures contemplated at Greenport. It should also be noted that a cement kiln is expected to experience the very fluctuations cautioned here and that Hitachi declined to offer a proposal for the reasons stated in the e-mail from Howard Franklin to Frank Sapienza quoted in the third paragraph of this section. Thus, this catalyst is definitely not suited for the Greenport operation as one of the authors of the report cited by MaDEP contends.

4.2 Response to Gas Temperature and Gas Distribution Comments

FOH comments that scale up of the SCR systems has been done and that systems far larger than those anticipated at Greenport are in service. Their conclusion is that scaling a system up for Greenport is therefore not a consideration. As explained in the SLC Report, the systems that have been significantly scaled up have not had the very high dust loadings anticipated at Greenport. This presents an additional technical challenge as the dust particles will have different trajectories than will the gas molecules and the size distribution of the dust particles will be significantly different than that encountered at the utility boiler systems that predominate the existing “high-dust” SCR applications. This is yet another uncertainty for the Greenport Project.

FOH’s consultant further showed their lack of knowledge about cement manufacturing by proposing that the manufacturing process be modified to accommodate the SCR as opposed to the matching the control technology to the process as is standard in permitting situations. CDM proposed a bypass system that would divert a quantity of gas from the gas duct between the fourth and fifth stages of the preheater. The purpose of this duct would be to provide a higher temperature level into the SCR to avoid the potential formation of ammonium sulfate salts in the SCR catalyst beds and subsequent catalyst deactivation, a situation that will likely occur at the normal operating temperatures anticipated at Greenport. While such a bypass is theoretically possible, it will be a significant technical challenge as well. Again, FOH’s lack of knowledge and understanding of the cement pyroprocess is again demonstrated. While this proposal will adversely affect the efficiency and productivity of the system, there are other more significant issues. Notably, CDM chose to consult SCR vendors rather than cement kiln vendors as to the feasibility of this proposal.

This duct is the introduction point for the feed to the pyroprocessing system. Diverting some of the gas flow from this duct will be a significant challenge and determining the feasibility of such a system will require a significant engineering evaluation. Disruptions to the gas flow in this duct can lead to significant disruptions of the feed distribution in the gas stream in the duct. Such disruptions have resulted in various problems in other plants including excessive dust loading in the outlet of the last stage (this will be the gas stream entering the SCR), plugging of the material ducts from the fourth and fifth stages due to fluctuations in material flows, material build-ups in the gas ducts due to altered gas distribution and other problems. These problems can result in dust loading much higher than currently anticipated dust loading into the SCR system, much greater temperature fluctuations and excursions, significantly more frequent kiln upsets and more frequent shut downs and subsequent restarts.

All of these factors dictate that a significant engineering study, more appropriately described as a research project, involving gas and dust distribution modeling is required to evaluate such a proposal. The modeling will likely involve both physical and computer models in an iterative process comparing computer evaluations to observation. The outcome of such a study is far from certain and not appropriate for the current permitting process.

4.3 Response to NO_x Inlet Concentration Variability and NH_3 Slip Comments

The FOH Response regarding NO_x inlet concentration once again demonstrates a basic lack of understanding about cement kilns and evidences a refusal to accept the fact that a cement kiln is not a utility boiler. FOH comments that experience at other facilities suggests that NO_x inlet concentration variability does not pose a threat to successful application of SCR citing vendor proposals and examples of coal-fired boilers and Solnhofer achieving significant NO_x reductions while producing minimal ammonia ("NH_3") slip. The fact remains that there has not been an SCR application on a source similar to the Greenport Project with all of the issues associated with the gas stream at Greenport.

Unlike a coal-boiler SCR application, an SCR system applied to a cement kiln will be faced with highly variable inlet NO_x loadings. The SLC Report explains that while coal-fired boilers are also subject to some routine variability in NO_x concentrations, the extent of variability is limited relative to the variability seen in cement kilns. Thermal NO_x formation in a cement kiln is the prevailing mechanism responsible for NO_x emissions. The rate of NO_x generation due to the thermal formation mechanisms is exponentially related to the peak gas temperature. Slight changes in the peak temperatures in the kiln burner flame can have a large impact on the short-term NO_x concentrations. The extreme sensitivity of the NO_x formation–peak temperature exponential relationship is one of the main reasons that the routine variability of NO_x concentrations in cement kilns is considerably larger than in coal-fired boilers. Factors that limit the relative NO_x variability in coal-fired boilers include the fact that peak gas temperatures are lower than in cement kilns, that both thermal and fuel NO_x formation are important in coal-fired boilers, and the fact that furnace temperatures in boilers are controlled over a relatively narrow range. In addition, the coal-fired boiler example provided by FOH of a gas stream approaching, but still significantly less challenging, than that of the proposed Greenport Project had an inlet NO_x concentration only 27% of the levels expected at Greenport.

On pages 4 and 37 of the FOH Response, it is claimed that NO_x concentration spikes will not pose an emission control problem because there is a reserve of ammonia on the catalyst surface to react with a sudden increase in NO_x concentration. SLC is not aware of any published data that quantifies the extent of the ammonia reserve and compares this on a molar basis to the duration and magnitude of NO_x concentration spikes in cement kilns. Accordingly, the FOH statement regarding ammonia reserves appears to be speculative.

There are also considerable kiln-to-kiln differences in the extent of the NO_x variability and the average NO_x concentrations. This is due, in part, to the differences in oxygen levels existing within the kiln and the impact of these variations on the usually highly efficient SO_2 uptake by materials within the kiln. Given no certified emission monitor or verifiable information on NO_x inlet concentrations or ammonia slip at Solnhofer, it is impossible to draw conclusions based on this example.

Due to the NO_x concentration variations in cement kilns, the NH_3 injection system on an SCR system applied to the Greenport Project would have to be controlled to ensure that the NH_3: NO_x molar ratio never exceeds a value of 1.0 and preferably remains below 0.9 during these short term NO_x concentration variations. Again, no experience or data on a similar source is available to predict likely NH_3 slip with an SCR system at the Greenport Project.

4.4 Response to Process Start-up, Shutdown and Malfunction Events Comments

The commentors suggest that SLC's concerns regarding gas conditions that could deactivate or otherwise damage the SCR are easily addressed by an SCR bypass when such conditions occur with a corresponding permit condition that allows NO_x emission limits not to be met under said conditions. Interestingly, SLC has suggested to the NYSDEC and the USEPA on more than one occasion that if SLC is required to install an SCR (despite it's likelihood of failure) that a permit condition would be necessary to allow SLC's NO_x emission rate to remain at 3.6 lb/ton clinker during periods of SCR bypass or malfunction. The agencies have not responded well to this suggestion, which further demonstrates the infeasibility of the proposal. Furthermore, the FOH Report does not include any analysis of the impact these bypass conditions on the overall NO_x emissions when significant, if not permanent, bypass conditions are factored in to the annual emissions.

4.5 Response to NO_x Removal Levels at Solnhofer Comment*s*

As detailed in Section 3, the best estimate available on NO_x reduction efficiency utilizes certified and publicly available data. The only "hard data" about emissions from the Solnhofer kiln are contained in the annual CEMS emissions reports for the period 1992-2002 inclusive. SLC analyzed this data to determine how the SCR system affected NO_x emissions on an annual average basis. The conclusion supported by the publicly available data is that the estimated NO_x reduction efficiency by the Solnhofer SCR system in 2002 was around 40% or less (annual average). An analysis of the entire dataset of publicly available data demonstrates that the efficiency is actually 34%. Despite vendor (presumably short-term efficiency) claims, no long-term or certified SCR inlet NO_x concentration data are available; therefore, a higher long-term NO_x reduction efficiency cannot be substantiated by available data.

4.6 Response to Vendor Proposals to Supply SCR for the Greenport Project Comments

The commenters criticized SLC's Bid Specification as being unreasonably strict and offering no opportunity for discussion or negotiation. On the contrary, SLC set requirements that were commensurate with the stringent operating conditions associated with the gas stream at the Greenport Project and reflected in the draft NYSDEC permit. This was done to reflect reality, not to discourage the bidders. As presented in the SLC Report, SLC's request for bids from four SCR vendors resulted in no firm and properly guaranteed bid to provide an SCR system for the Greenport Project. Each of the four could not commit to meeting the Bid Specification's real-world requirements. FOH then changed the specifications for the bid, which rendered them meaningless for the Greenport Project. Although FOH succeeded in obtaining a revised proposal from one of the SCR vendors, KWH furthered diluted the FOH bid specifications by ignoring the SO_2/SO_3 issue, rendering their response useless for the Greenport Project.[4]

Regarding FOH's claim that SLC was unrealistic in the bid requirements and unwilling to work with vendors, the claims are contrary to the facts. In summary:

- FOH claims "that SLC's bid specification package was unrealistic both in terms of the bid requirements and the penalties imposed for failing to meet vendor guarantees" and that "the unrealistic nature of the specifications and penalties virtually assured that no vendor would be willing to bid." The bid specification package prepared by SLC is a performance specification that defined certain performance criteria for an SCR system applied to the Greenport Project. Some of these performance targets were based on vendor (KWH) claims made to the USEPA (e-mail from Tom Lugar of KWH to Carla Adduci of the USEPA dated 06/04/03 provided in Attachment 2 to the SLC Report) in regard to the Greenport Project. While SLC agrees that KWH's claims appeared unrealistic given the available long-term performance data from Solnhofer, SLC entered the bid process with an open mind. To that end, performance targets were established and each vendor was required to propose an SCR system design that either met

[4] KWH did not provide a bid that can be evaluated by SLC as a prelude to spending millions of dollars on an SCR system that would be expected to perform at a specific level day in and day out. KWH's proposal can not be considered much more than an expression of interest.

the targets or take exception to those targets. The only requirement SLC imposed on vendors wishing to take exception to any or all of the performance targets was that they provide a discussion of the reason for taking an exception and a description of the exact nature of the exception. (*See* Bid Specification, Sections 1.2.1 Exceptions, 1.3 Request for Additional Information and 3.1 Performance Standards provided in Attachment 2 to the SLC Report.) Any experienced vendor recognizes that this approach to purchasing pollution control equipment is the starting point for discussions and exchanges with a potential purchaser.

The bid specification also asked for a good deal of information about the vendor's experience. To some extent, SLC made this request to satisfy requirements imposed by NYDEC in its letter of July 2003, but SLC also requested this information because it is a prudent course of business given the unproven nature of the SCR application contemplated by the specification. SLC asked the vendors to back up their claims with data and facts, and in the end, none of the vendors produced any data to support their claims (e.g., long-term performance data on NO_x reductions at Solnhofer).

Perhaps FOH takes issue with the concept of exceptions in a specification. This is a common practice in the business of procuring multi-million dollar pollution control systems and is one every experienced vendor should be familiar with. In such a procurement process, an owner is usually faced with several competing bids and must decide between those bids based on factors such as overall cost, vendor experience and reputation, the exceptions taken to the bid specification, and the guarantees the vendor is willing to provide. Usually, vendors who take more exceptions or provide weaker guarantees also provide a lower-cost system. This dilemma requires a careful evaluation where the competing factors are weighed, and a vendor is finally selected based on an assessment of which proposal comes closest to meeting the purchaser's overall needs. In the case of the Greenport SCR bid specification, none of the vendors provided a response that even remotely allowed SLC to make such an evaluation. This did not occur because the specification was "unrealistic;" it occurred because vendors are not in a position to make a commercial offering of SCR technology for the Greenport project at this time. Further, the two vendors who did provide an initial response were given a second chance to provide a proposal that SLC could evaluate. In the end, neither did.

- FOH claims that SLC was unwilling to provide additional information or accommodate requests for extensions. SLC did grant a request for an extension and provided the additional time to the other vendors as well despite the fact that they had not requested it. SLC addressed all questions put forward in a timely and appropriate fashion and ensured that all vendors had the same information. (*See* SLC letter dated 09/05/03 to the Vendors concerning Errata and Clarification, SLC letter dated 09/18/03 to the Vendors granting an extension until 10/03/03 provided in Attachment 2 to the SLC Report.)

- FOH claims that the NO_x reduction and catalyst life targets were too stringent. In fact, the reduction targets in the bid specification were based upon claims made by the very same vendor that responded to the FOH bid request (KWH) to the USEPA (e-mail from Tom Lugar of KWH to Carla Adduci of the USEPA dated 06/04/03 provided in Attachment 2 to the SLC Report). As stated above, vendors could take exception to any specification requirement including NO_x reduction and catalyst life. All that SLC asked was that the vendors clearly describe any exceptions and provide an explanation for why the exceptions were taken.

- FOH claims that the revised proposal they secured from KWH addresses all of the concerns backed up by guarantees in applying an SCR system to the Greenport facility. In fact, the vendor specifically excludes one significant concern regarding SO_2 oxidation. KWH's rejection of this key specification causes the proposal to be both unrealistic and a significant risk to the environment and community.

- FOH claims that the liquidated damage provisions of the required guarantees were so onerous that no vendor would offer a bid. However, the one proposal that FOH was able to secure took exception to FOH's liquidated damage provisions and instead proposed provisions more penalizing than the liquidated damages proposed by SLC.

- FOH continues with unsubstantiated claims regarding the performance of the SCR system at the Solnhofer facility. These claims are inconsistent within themselves in that they claim the system has been in service for 12 months (a period of 8,760 hours assuming 100% availability) when they discuss NO_x reduction but claim it has been in service 24,000 hours (a period of approximately three years considering the availability of the kiln) when they discuss catalyst life.

- FOH continues to demonstrate their lack of knowledge and understanding of cement pyroprocessing systems. They refuse to acknowledge that such systems are inherently different from utility boilers and power generation systems and fail to demonstrate an understanding of the difference between different types of cement pyroprocessing systems. The result is FOH advocating a technology that is likely to fail and which carries high risk to the environment and community.

5.0 Legal Basis of SCR as NO_x LAER for Greenport Project

The commentors also take issue with the SLC's regulatory analysis that SCR and its associated emission rate are not NO_x LAER for the Greenport Project. All commentors assert that the Greenport Project and Solnhofer are within the same source category for purposes of LAER. Additionally, they allege that SCR is achieved in practice at Solnhofer and, in any event, SCR would be expected to effectively operate at the Greenport Project based on the factors of "availability" and "applicability." As explained below, the comments are not compelling; nor are they sufficient to revise NYSDEC's current NO_x LAER determination for the Greenport Project. Given the commentors vigorous assertions regarding the SLC's source category analysis, this topic is evaluated to a greater extent than the others discussed below.

As SLC outlined in the SLC Report, the definition of LAER establishes two separate and distinct tests that must be applied to the Greenport Project's technical data to determine if SCR and its NO_x emission rate is appropriate (from a regulatory perspective) for the Greenport Project. The failure of a control system to satisfy at least one of these tests demonstrates that the emission rate that might result from the application of the SCR to the Greenport Project is not LAER for the Greenport Project.

> ***Test One***: Whether SCR technology and its resulting emission rate have been "achieved in practice" for the Greenport Project's source category?
>
> ***or***
>
> ***Test Two***: Whether SCR technology and its resulting emission rate can "reasonably be expected to occur in practice" at the Greenport Project?

The SLC Report clearly demonstrates that SCR fails both LAER tests as applied to the Greenport Project. Specifically, SCR and its site-specific associated emission rate have neither been "achieved in practice" for the Greenport Project's "source category," nor are SCR and its site-specific resulting emission rate, based on the Greenport Project's proposed operating parameters and design, "reasonably expected to occur in practice" at the Greenport Project.

Additionally, despite the claims to the contrary, the allegation that SCR will reduce NO_x emissions approximately 1,800 tons per year over the Greenport Project's currently established NO_x LAER limit is simply incorrect. For the reasons noted in the technical analysis above, it is likely that the SCR system will fail altogether, meaning that there will be no reductions in NO_x emissions at all, much less a reduction greater than the system proposed by SLC. Also, an evaluation of the publicly available data from the Solnhofer facility demonstrates that the actual NO_x reduction at that facility is more on the order of 34%, which equates to a higher emissions level than the level guaranteed with MSC and SNCR. Thus, the environmental benefit projected by FOH is much like the Emperor's clothing in the fable. However, pursuant to Subpart 231-2, even if the combination of SNCR and MSC results in a higher NO_x emission rate than with SCR (and thus a higher NO_x Potential to Emit ("PTE")), which it will not, then SLC must purchase additional NO_x emission offsets to match any increase at a ratio of 1.15 to 1--thereby offsetting upwind NO_x emissions at an even greater rate than the hypothesized benefit associated with SCR. Further, these offsets must be purchased at the Greenport Project's NO_x PTE, regardless of the whether the Greenport Project will always run at maximum capacity, thus potentially producing an even larger environmental benefit. Accordingly, there is no regulatory risk associated with the current LAER determination due to the mandatory offsets that are required.

Source Category

The express language of New York's LAER definition, under Test One, requires that a source category determination be made. This review is consistent with the federal LAER program.[5] The commentors, however, dispute SLC's conclusion that the Greenport Project and Solnhofer are not in the same source category.

Initially, these commenters have misinterpreted the source category issue by noting basic Maximum Available Control Technology ("MACT"), New Source Performance Program ("NSPS"), Prevention of Significant Deterioration ("PSD"), and Non-Attainment New Source Review ("NA NSR") program purposes and applicability differences. Project opponents have previously used this broad-brush, "red herring" technique in an attempt to prompt NYSDEC to skip necessary regulatory evaluation steps.[6] However, these off-point statements on SLC's use of other Clean Air Act (CAA) programs in its LAER analysis are not relevant here. Specifically, SLC noted these programs to correctly demonstrate the accepted use of source categorization throughout the CAA, while also commenting on program differences:

> "Category classification, and sub-classification, is a process inherent to many Clean Air Act programs (*e.g.*, NSPS, MACT, PSD, and NA NSR). For example, EPA has distinguished certain electric generating unit sources based on size *and use* (*i.e.*, whether the unit is selling electricity) and mineral processing sources simply due to their size *and mobility (i.e.,* whether the crusher is mobile*)*. *See generally* 40 CFR 60, Subparts Da and OOO. And while programs other than NA NSR do evaluate cost in their analyses, <u>all</u> of these programs, including NA NSR, use category sub-categorization to address technological feasibility limitations--apart from any economic analysis." .

SLC Report, p. 5-4.

What is important to recognize, and what commentors improperly attempt to dismiss, is that source categorization is used by several CAA programs (including NA NSR), irrespective of FOH's comment on the fluidity or purposes of these programs. In fact, New York's LAER

5 As FOH stated in footnote 11 of the FOH Response, these two programs are compatible.

6 For example, FOH and MaDEP, in their previous SCR responses, have summarily dismissed SLC NO_x LAER new source arguments simply because they were from a PSD, not an NA NSR, matter on the basic, yet off-point, differences between the two programs. However, as seen on page 39 of the FOH Response, FOH is quick to use SLC's noted program overlap (through its use of a PSD BACT decision to prove a LAER point) when it serves FOH's purpose.

definition not only incorporates this principle, *but uses the exact term* "source category"—thus clearly requiring its evaluation.

FOH attempts to quickly dismiss SLC's source category analysis (despite expressly acknowledging the need for source category-specific review in its response at p. 58) by stating: "The issue in this case is not, however, whether the two cement plants are in the same source category but whether the facilities are sufficiently similar in terms of processes and gas streams to allow for the successful application of the SCR technology currently in use at the Solnhofer facility at Greenport." FOH Response, p. 66. This is misleading. The similarities of the gas streams associated with facilities in other source categories is a legitimate LAER issue, but under LAER's Test Two, not Test One. Test One focuses on similar emission rates currently being achieved within the same source category. Thus, FOH has confused Test Two with Test One and in doing so has glossed over the required source category analysis.[7]

FOH's statement, then, in essence proposing that NYSDEC should simply skip LAER's Test One and its source category analysis, makes two things clear. First, FOH has no legitimate argument that the Greenport Project is not in the same source category as Solnhofer. Second, FOH has accepted that whether SCR should be applied to the Greenport Project will be determined solely via LAER's Test Two, regardless of Test One's "achieved in practice" or source category issues.[8]

MaDEP's entire legal response essentially focuses on why Portland cement plants should not be sub-categorized. Its argument is simple: because the federal PSD program classifies Portland cement plants as one of the 28 listed major sources that have a 100 tons per year (as compared to 250 tons per year) threshold for major new source applicability purposes, NYSDEC must consider all Portland cement plants (regardless of size, gas stream, raw material content, *etc.*) as

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7 FOH's comment on *In re: Knauf Fiber Glass, GMBH*, 1999 WL 64235, PSD Appeal Nos. 98-3 through 98-20 (Feb. 4, 1999) is off-point. Unlike in *Knauf*, SLC is not arguing that it must review only its own cement plants in its source category analysis. *Knauf*, as used by FOH, stands for the proposition that "[i]f a company can claim that the only facilities similar to a proposed project are its own facilities, this objective of the BACT program would not be fulfilled." SLC, contrary to the facts in *Knauf*, has reviewed many cement plants to determine if they were in the Greenport Project's source category (under Test One) and other sources, processes and gas streams (under Test Two), beyond what SLC owns or operates. Thus, this decision, as used by FOH, is not relevant.

8 *See* FOH Response, p. 60 ("SLC must no doubt concede that Solnhofer and Greenport are both cement plants. Once that point is conceded, the focus of the analysis must turn to whether the emission reductions being achieved by Solnhofer using SCR can "reasonably be expected to be achieved" at Greenport [*i.e.*, LAER's Test Two].").

one source category under NA NSR's LAER program. Such an interpretation is not reflective of how NA NSR is implemented in practice.

The 28 listed source categories apply only to applicability--not to the program's case-by-case technology requirement. This case-by-case determination process is common to both the PSD and the NA NSR programs, and does not, as MaDEP argues, eliminate Test One of LAER. MaDEP Response, p. 12. Under MaDEP's strained construct, for example, all chemical processing plants (which are also a listed source category includes over 500 different processes and products ranging from acetone to zinc oxide) would be required to install the same BACT controls, despite obvious and profound process differences.

This does not mean that a source category would always be subcategorized, but it does mean that:

1. It is improper to argue that just because a category is one of those listed in the NSR rules, it cannot be subcategorized; and
2. Subcategories may be (and have been identified) by size, process, raw materials, and other factors.

The SLC Report provides clear examples of New York situations where electric generating units and steam boilers were sub-categorized for the purposes of LAER. While ALJs and the NYSDEC Commissioner do not always outline and precisely identify every aspect of a LAER analysis,[9] and often combine or generalize terms of art, the result is inescapable. Simply put, ALJs and the NYSDEC Commissioner have not required a specific technology's emission rate as LAER for one unit, while requiring it for another such unit in the same general source category. The rationale for the difference in LAER has been based on fuel, size, *etc*. These cases are clear examples of a more detailed source sub-categorization under LAER, whether or not such terms of art were used in these decisions.

In a further attempt to discredit these LAER sub-categorization decisions, MaDEP states "[f]or each of these permits DEC applied the source categories EPA had previously promulgated for

[9] *E.g.*, source category determination, achieved in practice (*i.e.*, demonstrated), availability, and applicability.

these sources."[10] MaDEP Response, p. 13. Here, MaDEP alternatively implies that a LAER source can be only sub-categorized if an EPA-promulgated subcategory exists (*e.g.*, NSPS, MACT). This statement is unsupported.[11] Ironically, because Solnhofer (unlike the proposed parameters for the Greenport Project) uses hazardous waste as fuel, under MaDEP's concept, the Greenport Project and Solnhofer could actually be separated under the EPA-promulgated Portland cement MACT sub-categories for coal and hazardous waste kilns, so LAER sub-categorization is appropriate under the test they espouse.

Thus, despite statements to the contrary, source categorization is an essential part of LAER's Test One, prompting a case-by-case review. The SLC Report and the preceding technical analysis accurately conclude that the Greenport Project and Solnhofer are not in the same source category. Thus, LAER's Test One is not satisfied. The responses filed with the NYSDEC do not alter this conclusion.

Achieved in Practice

Even if the opposition is determined to define Greenport and Solnhofer as belonging to the same source category (considering size, raw materials, *etc.*), an analysis must also be made, under LAER's Test One, that the emission rate is "achieved in practice." The SLC Report correctly equates this concept to a verified, publicly available demonstration. FOH argues that Solnhofer "has been achieving emission reductions of approximately 82% for almost three years using SCR[,]" thus allegedly demonstrating that "emission reductions" have been achieved in practice and that SCR is LAER for the Greenport Project. FOH Response, p. 71.

Apart from the source category issue, what FOH calls "demonstrated" is based on nothing more than speculation, hearsay and unverified information, not on publicly available, verifiable data. The limited emissions data available indicate an annual average NO_x reduction efficiency of less than 40%. As noted in detail in the technical analysis above, the commentors have not submitted

10 That NYSDEC incorporated a NSPS source category-based applicable requirement into a Title V permit in no way precludes a source category review under LAER (with limits that would eventually also be incorporated into a Title V permit). This comment states the obvious without being relevant to the issue at hand.

11 MaDEP provides no support for its conclusion that categorization in SLC's cited decisions was based on EPA sub-categorization (which may categorize a source category simply based on whether or not it will sell electricity to the grid).

any publicly available, verified data to dispute this calculation.[12] Moreover, a careful review of the little publicly available data available for Solnhofer over the last 10 years demonstrates that the actual reduction achieved in practice is less than 40%, on the order of 34%.

Further, SLC has never attempted to dismiss Solnhofer, or any other foreign facilities or related decisions, simply because they were foreign, as FOH incorrectly contends. Rather, SLC noted and cautioned about the very real issues that occur when analyzing such facilities. *See* SLC Report, p. 5-18 ("[B]asic logistical issues arise when evaluating the "achieved in practice" nature of foreign (*i.e.*, Solnhofer) SCR technology and emission rates: language and cultural barriers; translation problems; resistance from local and government regulators; test method variations and data availability."). Nowhere are such availability and verification issues relating to foreign data more apparent than with Solnhofer. *See* FOH Response, p. 69 (acknowledging problems as to foreign facility verification). Any claim to data allegedly available by FOH must be disregarded until provided in a verified and accurate form, and only then compared to Greenport's specific operating parameters. At this time, FOH has provided no new verified data upon which to revise NYSDEC's previous LAER determination[13].

Availability

FOH also contends that, under LAER's Test Two, SCR would be reasonably expected to provide the Greenport Project with an 85% NO_x control efficiency rate, in part, because the technology is presently commercially available through the catalyst vendor KWH. What FOH has been able to secure, however, is not a commercially available SCR proposal for the Greenport Project at all--but rather a proposal for a different plant with very different operating parameters and source material composition.

The FOH Response correctly notes that a vendor proposal provides an indication of commercial availability; however, NYSDEC and USEPA do not consider a vendor proposal or even a vendor

[12] As NYSDEC is aware, a LAER "achieved in practice" analysis can not be made through speculative claims (*see In Matter of Wawayanda Energy Ctr., LLC*, 2001 N.Y. ENV LEXIS 5, (NYSDEC, Jan. 11, 2002) (project opponent asserted no new technological developments since last LAER determination)).

[13] It appears that even the opponents are having little success in obtaining data from Solnhofer, richly confirming the difficulties encountered by SLC in attempting to do so at an earlier date.

guarantee alone to be sufficient justification of availability.[14] Nor does a vendor proposal or guarantee demonstrate "availability" if it is hedged to the point of rendering it useless.[15] This is exactly what FOH did in obtaining a vendor proposal for the Greenport Project from KWH.

As noted above, SLC prepared a request for proposal ("RFP") and submitted it to four vendors, including KWH. KWH initially wrote to USEPA Region 2 stating that it could provide an SCR system for the Greenport Project with a 90-93% NO_x control efficiency (e-mail from Tom Lugar of KWH to Carla Adduci of the USEPA dated 06/04/03 provided in Attachment 2 to the SLC Report). Accordingly, the RFP was tailored precisely to the operating parameters of the Greenport Project and its raw material feed to ensure all established LAER limits would be met.[16] A bid must be prepared to ensure permit imposed emission limit compliance.[17]

KWH declined to provide a bid. KWH stated that the application of SCR to the Greenport Project would "not be risk free due to technical uncertainties involved in the process conditions for U.S. application."[18] Moreover, KWH stated that because of the differences between the two plants, "[t]he Solnhofer plant cannot be used as a benchmark to extrapolate the SCR catalyst design for the Greenport Project."[19] These statements speak for themselves as to commercial availability. Notably, KWH has not provided any technical evidence that the reasons for this prior conclusion have currently changed. Moreover, the other vendor responding to FOH's bid

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14 *See Matter of Keyspan Energy*, 2001 WL 470660, *8 (NYSDEC, Apr. 18, 2001) (rejecting $SCONO_x$ as LAER despite "EPA and vendor endorsement").

15 *See In Re Three Mountain Power, LLC*, 2001 EPA App LEXIS 7, *30, n. 12 (May 30, 2001). "Unacceptable qualifications include inadequate liquidated damages protection of only 15% of the contract cost, inadequate equipment warranty of only one year, limited catalyst life guarantee of only three years, and voiding of warranties if plant upsets occur." *Id*.

16 Due to the degree of controversy regarding SCR use on cement plants, SLC prepared a RFP more detailed than usual in order to ensure that each area of concern was fully addressed. Petitioners implied that the RFP was "rigged" to fail, but that is not the case: SLC has been absolutely clear as to its concerns with SCR and the RFP simply included those concerns (*e.g.*, higher sulfur in the gas stream). If the RFP seemed comprehensive, it was because SLC wants what they end up with to work and not result in violations; hence care was taken to address potential problems. It is worth noting that it is easier for someone to dismiss legitimate concerns when they are not the ones responsible for operating the equipment in compliance with all requirements.

17 *See U.S. v. Public Service Co. of Indiana*, 1977 U.S. Dist. LEXIS 13675, *12 (S.D. Ind. 1977) ([DOJ] challenges the [CAA] guarantee specifications as being unreasonably strict [compared to other equipment] . . but the fact remains that other equipment does not have to meet a strict law-imposed standard for equipment performance, whereas the emission control equipment has as its sole function the responsibility of causing the unit to operate without violating applicable limitations imposed by law, and, since defendant's Gibson Station is a base load generating station, the equipment must operate substantially continuously in compliance with such legal requirements.").

18 September 19, 2003 letter from Thomas Lugar, CEO, KWH Catalysts, Inc. to Phillip Lochbrunner, SLC.

19 October 3, 2003 letter from Thomas Lugar, CEO, KWH Catalysts, Inc. to Phillip Lochbrunner, SLC.

request confirmed earlier statements by KWH and the weakness of KWH's more recent proposal. The response from Hitachi confirms that the catalyst bed will rapidly deteriorate and neither FOH nor KWH has addressed this response in their submissions. Thus, any change in KWH position must be due to the application of SCR to a different set of parameters for a different cement plant.

FOH, unsatisfied with SLC's comprehensive analysis, re-submitted a revised RFP (one which, by the way, did not meet the operating parameters of the Greenport Project) to several vendors, including KWH. Only after further diluting the bid specifications did KWH submit a highly altered and technically inconsistent vendor proposal for an SCR unit at the Greenport Project. Most notably, while dismissing the technically apparent SO_2 impacts to an SCR's catalyst, KWH refused to guarantee this alleged "non-issue." Thus, KWH's revised vendor proposal does not demonstrate commercial availability under SLC's cited decisions, LAER policy, good engineering judgment or common sense. As such, SCR can not be expected to perform as claimed by FOH and MaDEP and, thus, is not appropriate control technology to achieve LAER for the Greenport Project. The Greenport Project, despite contentions to the contrary, should not serve as a technology-creating experiment for the cement industry.[20]

Applicability

To satisfy LAER's Test Two, a control technology must be both available and applicable. An available technology is "applicable" if it can be installed and reasonably expected to operate on the source under consideration. *See* Workshop Manual, p. B.17. NYSDEC is required to review applicable technology and associated emission rates for other *categories* of emission sources--a concept known as technology transfer. *See* Workshop Manual, p. G.3. The limited application of "technology transfer" is dependent upon a number of important factors, such as similar raw materials, gas streams and processes.[21] As the FOH Response notes from the *Workshop Manual*,

[20] While FOH attempts to downgrade the important role cement plays in New York's construction industry by making a haphazard comparison with another commodity, energy (which can also be purchased out of State), MaDEP appears to disagree with FOH's conclusion: "DEP recognizes the need for modern state-of-the-art cement plants to provide critical building material in the 21st century." MaDEP Response, p. 16; FOH Response, p. 72.

[21] The most important of these is the gas stream, since that is usually what the control device has to deal with.

when significant differences between source types exist, technology transfer is presumed to be inapplicable. FOH Response, p. 75.

FOH's premise for the application of SCR technology transfer from Solnhofer or from utility boilers to the Greenport Project rests on one easily disputable point: an incorrect comprehension that the gas streams are the same. They are not. As noted above, FOH's cited charts make this very case for SLC and we are unsure as to why FOH included them in its analysis. The Hitachi response similarly confirms the dissimilarity of the two gas streams. The preceding technical analysis clearly proves that Solnhofer and the Greenport Project will not have the same gas streams and that technology transfer is inapplicable. As explained in the SLC Report, a regulatory agency's attempt to push technology transfer too fast, too soon has resulted in devastating environmental and public impacts. It is not inconceivable, as with AEP's Gavin Generating Station in Cheshire, Ohio, that SCR's application to the Greenport Project could result in a sulfuric acid cloud over the Hudson River Valley. Again, LAER is not intended to be an experiment but an application based on the "range of certainly" principle. The commentors Responses lose sight of this LAER maxim and seek to impose upon the Greenport Project a technology that does not apply and that creates an unacceptable environmental risk.

6.0 Conclusion

Based on the foregoing and the SLC Report, SCR's resulting site-specific NO_x emission rate is not NO_x LAER for the Greenport Project. SCR has not been achieved in practice, because Solnhofer is not in the same source category as the Greenport Project, and, even if it was, it does not appear, based on the extremely limited data available to the public, that SCR has even been achieved in practice at Solnhofer. Additionally, SCR cannot reasonably be expected to occur in practice at the Greenport Project, because SCR is not commercially available for the Greenport Project, and, even if it was, SCR is technically infeasible for the Greenport Project. Accordingly, NYSDEC's previous NO_x LAER determination for the Greenport Project remains valid.